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ABSTRACT

A Harding School (Worthington, Ohio) population of 77 adolescent patients, ages 12 to 17, were administered the Woodcock Reading Mastery Tests and the Key Math Diagnostic Arithmetic Tests. Averages were calculated for the length of hospitalization, age at admission, full scale intelligence quotient (IQ), average grade equivalent gain for the total period, and the average grade equivalent gain per month. The expected grade achievement and the expected grade level were calculated for the reading and mathematics program, respectively. A Pearson's Product Moment Correlation was used to determine the relationship of pretest and posttest performance to years behind grade level, as well as between length of hospitalization and grade equivalent gain per month. Among the seven major results found were that (1) there is no significant correlation among the age at admission, IQ, and length of hospitalization, or between IQ and age at admission; (2) there is a significant negative correlation between years behind expected grade achievement and the pretest or posttest grade equivalent for Woodcock Reading and Key Math; and (3) there is no significant correlation between severity of psychiatric diagnosis and grade equivalent gain per month for the Woodcock Reading and Key Math. (PN)

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An Analysis of School Achievement for Woodcock Reading Mastery Tests and Key Math Diagnostic Arithmetic Tests of Adolescents in a Psychiatric Hospital

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Achievement of Adolescents in a Psychiatric Hospital

An Analysis of School Chievement for Woodcock Reading Mastery Tests and Key Math Diagnostic Arithmetic Tests of Adolescents in a Psychiatric Hospital

Introduction

Psychiatric hospitalization tends to be painful and costly. Sankar (1978, p. 134) refers to a study conducted in 1976 which showed that age at admission to the hospital, I.Q., sex and race are more directly involved in a child's psychiatric hospitalization than the family status and psychiatric diagnosis. He also reported on a study which indicated that the younger the child at the time of admission, the longer the hospitalization and the lower the I.Q. The results also indicated that the I.Q. of the child was correlated with its sex. Female patients may not be brought to the hospital unless the nature of their problem is more severe and their I.Q. tends to be lower. It was concluded that the length of the hospitalization depended on the I.Q. of the child as well as the depth of involvement of biological factors.

It is only in recent years that psychiatric hospitals have provided a school for its school age patients. Research on the performance of psychiatric children on achievement tests generally and specifically on the Woodcock Reading

Mastery Tests and the Key Math Diagnostic Arithmetic Tests seem to range from limited to nonexistent.

Grenstein and Strain (1977) administered the Key Math Diagnostic Arithmetic Tests to a group of learning disabled adolescents. These children, who ranged in age from 12 to 17, were performing at least two years below expected grade level. The results indicated that: "(1) mean LD performance peaked at approximately the fourth grade level of difficulty; (2) there was marginal variation in performance across 14 subtests; (3) a strong negative correlation existed between years behind grade level and seven of the Key Math Subtests; (4) the subtests factored into two ability categories, as opposed to the three suggested by the test developers; and (5) LD performance was quite distinct from that of normal children in terms of types of computational errors made on the tests" (p. 275).

A search of the literature revealed only one article (Iwanicki, 1976) where the Woodcock Reading Mastery Tests were used to compare the reading performance of several groups of public school children. These were not psychiatric patients of any hospital nor were any studies of such patients discovered.

Comments from literature that may have some relevancy to the present investigation indicate that the mastery scores

should be used to compare performance across subtests or across grade levels since mastery scores report achievement and achievement gain in equal interval units. For this reason grade equivalent scores, since they are not expressed in equal interval units, cannot be used to compare quantitative gains on a particular subtest or make comparisons across subtests. They can only be used to make qualitative comparisons of pretest status versus posttest status for a particular group of children.

Iwanicki (1976) used the correlated t-test to test for statistical significance of the pretest to posttest mastery score gain. The results indicated that there were statistically significant gains for each grade level in his study.

In summary, Sankar indicated that the younger the child at the time of admission to a psychiatric hospital, the longer he would remain in the hospital and the lower his I.Q. would be at the time of admission. Females are not admitted to the hospital by their parents until their problem becomes more severe.

Achievement test results, especially for the Key Math Diagnostic Arithmetic Test, indicate that psychiatric patients may be at least two years below expected grade level.

Purpose of the Study

The purpose of the study was to examine trends in the population of the Harding School (Worthington, Ohio), from its beginning in January, 1973 through December 31, 1978. Of particular interest was a sample of 77 students who were administered the Woodcock Reading Mastery Tests and the Key Math Diagnostic Arithmetic Tests.

To assess the impact of the school program, the following research questions were asked:

1. What was the profile of the learning disabled children?

2. What was the relationship between years behind grade level and the Woodcock Reading Mastery Test Scores or the Key Math Diagnostic Arithmetic Test Scores?

3. Were there significant gains for children confined to a psychiatric hospital on the Mastery Tests or the Key Math Diagnostic Tests?

4. Was there a relationship between the severity of the psychiatric diagnosis and any grade equivalent gains on either the Woodcock Reading Mastery Tests or the Key Math Diagnostic Arithmetic Tests?

5. What was the relationship between length of hospitalization and gain per month in achievement for either Woodcock Reading Mastery Tests or Key Diagnostic Arithmetic Tests?

6. What was the comparison between school achievement for patients and expected school achievement for normal children?

Methodology

Data were collected from the patients' records in the school and the hospital. The sample consisted of 39 boys and 38 girls. The adolescents ranged in age from 12 to 17. Some of them were inpatients of the hospital and others were day patients being treated through the Adolescent Day Treatment Program.

This particular study was conducted to evaluate the students at the Harding School on reading and arithmetic. The day patients and inpatients were not treated differently.

Results

Patients' Profile

The average age of the boys at admission was 15 years and 11 months and the average age of the girls was 15 years and 9 months. The overall range in age for both groups was from 13 years to 18 years 11 months.

The students were administered the Woodcock Reading Mastery Tests and the Key Math Diagnostic Arithmetic Tests. The boys' mean performance in reading was ninth grade eight months and the girls' mean performance in reading was ninth

grade six months. The boys' mean performance in mathematics was seventh grade five months and the girls' mean performance in mathematics was seventh grade two months.

There is an average age difference of two months between the boys and girls as well as a two month difference in reading performance between the boys and girls. This similarity is not due to the scoring method.

Analyses

Averages were calculated for the length of hospitalization, age at admission, full scale I.Q., average grade equivalent gain for the total period, and the average grade equivalent gain per month. The expected grade achievement was calculated for the reading program and the expected grade level was calculated for the mathematics program.

A Pearson's Product Moment Correlation was used to determine the relationship of pretest and posttest performance to years behind grade level as well as between length of hospitalization and grade equivalent gain per month.

The t-test was used to determine if there was a statistically significant gain per month for patients compared to the expected gain of a normal student. Also, the statistical significance of the pretest to posttest gain for each test was evaluated using the correlated t-test.

The students received a psychiatric diagnosis when they entered the hospital. The rank order of severity of their

problems was determined by a group of psychiatrists at the hospital.

Results of Analyses

The average hospitalization was 7.11 months for the boys and 5.65 months for the girls. At the time of admission to the hospital the students were given I.Q. tests. Sankar's study (1978) and his literature review indicated "that the lower the age at admission, the lower will be the I.Q., and the longer will be the term of institutionalization" (-. 140).

There were 15 males and 18 females with an I.Q. of less than 100.

The psychiatric diagnosis indicated that most of the students suffered from "behavior disorders" or "neuroses."

In order to determine if the students were behind grade level in reading or mathematics, an expected grade level had to be calculated. The data for these tests were recorded in grade equivalents.

For the Woodcock Reading Mastery Tests, a formula proposed by Zintz (1977, p. 50) was used:

$$\text{Expected grade achievement} = \frac{\text{years in school} \times \text{I.Q.}}{100} + 1.0$$

For the Key Math Diagnostic Arithmetic Tests grade expectancy was determined by subtracting six from age at admission. It was assumed that most children were at least six years old by the time they entered the first grade. Also,

this information was used in the formula for expected grade achievement in reading for the number of years a student was in school.

The expected grade achievement formula includes the value "years in school." Since the data for this study included the age of the child at admission and length of stay in the hospital, some techniques had to be used to obtain the value "years in school." After consultation with several members of the education faculty, age six was selected as the best estimate of the child's age at the time of admission to the public or private school.

A Pearson's Product Moment Correlation was used to determine the relationship of pretest and posttest performance to years behind grade level. The results of this analysis are summarized in Tables 1 and 2. There was a statistically significant ($p = .05$) negative correlation between years behind grade level and the pretest and posttest grade equivalents for Woodcock Reading Mastery Tests and the Key Math Diagnostic Arithmetic Tests.

Insert Table 1 about here

The correlation analysis was based on the assumption that years behind grade level can be equated with academic

disability. That is, the more years behind grade level the greater the student's academic deficit.

Thus the smaller the absolute value of the correlation coefficient the greater the improvement in student's reading abilities between the pretest and the posttest. The improvement does not seem to be as great for the female students as for the male students. This may be seen from a different perspective in Tables 4 and 5.

Insert Table 2 about here

It seems that in spite of improvement in academic performance between the pretest and the posttest, there is still a high negative correlation between the posttest grade equivalent and the years behind grade level.

There is presented in Table 3 the number of students who were above, at or below grade level for the pretest and the posttest. It may be observed that there was a small change between the pretest period and the posttest period.

Insert Table 3 about here

An analysis of the data in Table 3 indicates that for the Woodcock Reading Mastery Tests, one male student moved

from below grade level up to grade level. For the female students, four moved up from below grade level, three to above grade level and one to grade level.

Three male students moved up from below grade level to above grade level on the Key Math Tests. One female student moved from grade level to above grade level and two moved up from below grade level to above grade level.

The average grade difference between the expected grade level and the pretest or posttest grade equivalent is shown in Tables 4 and 5 for the Woodcock Reading and Key Math Tests, respectively.

Insert Tables 4 and 5 about here

There was very little change in the above grade level category between the pretest and posttest compared with the exptected grade achievement for male or female using the Woodcock Reading Mastery Tests. For those students who were below grade level, the boys moved up 0.8 of a grade while the girls only moved up 0.4 of a grade.

Improvement was much greater in mathematics. The boys who were above grade level moved up 0.7 of a grade while those below grade level moved up 0.6 of a grade. The girls who were above grade level lost 0.4 of a grade between pretest

and posttest. However, the girls who were below grade gained about 0.6 of a grade.

The clinical staff ranked the students' psychiatric diagnoses in order of severity from 1 to 10 being the most severe. The order of severity is given in Table 6.

Insert Table 6 about here

The total gain in grade equivalents for the sample has been partitioned according to the psychiatric diagnosis of the students. These results are given in Tables 7 and 8. The total gain covers the period between the pretest and the posttest.

Insert Tables 7 and 8 about here

There were no students diagnosed as drug dependent, non-psychotic organic brain syndrome. As previously stated, most of the students were diagnosed as suffering from behavior disorders or neuroses.

There were 15 students with no gain or less on the Woodcock Reading and 14 with no gain or less on the Key Math Tests. Most of the positive gain for both tests was between 0.1 grade and 2.5 grades.

The total gain per student was divided by the number of months they were hospitalized to give a gain per month. It was postulated that there would be a correlation between the severity of psychiatric diagnoses and grade equivalent gain per month. This was not affirmed for either the Woodcock Reading Mastery Tests or the Key Math Diagnostic Arithmetic Tests.

It was also postulated that the more severe the psychiatric problem the longer the stay in the hospital and the smaller the per month gain for the Woodcock Reading or Key Math Tests. The data did not seem to confirm these postulates.

There was a statistically significant ($p = .05$) negative correlation for each cell in Table 9 (Relationship Between Length of Hospitalization and Grade Equivalent Gain Per Month in Achievement). The negative correlation indicates that the longer the students were in the hospital the smaller the per month gain in achievement. As indicated earlier there was no correlation between severity of psychiatric diagnosis and grade equivalent gain per month. There must be some factors which were not investigated in this study which are responsible for this phenomenon.

Insert Table 9 about here

The largest gains per month were within the first four and one half months except for females on Key Math. They seemed to gain at a similar rate through 13.4 months in the hospital. This may be due to the abstract parts of the mathematics program.

It was assumed that a normal child would gain 0.1 grade per month in school. The research hypothesis stated that there would be statistically significant gain per month for those students attending the Harding School compared to the expected gain of a normal student.

The results of the t-test indicated that the boys and girls did show a statistically significant ($p = 0.5$) gain per month for the Woodcock Reading Mastery Tests as well as the Key Math Diagnostic Arithemetic Tests.

In spite of the good progress by many of the students, there were some who did not reach a gain of 0.1 grade per month. There were 46 percent of the boys compared to 18 percent of the girls who did not achieve 0.1 grade per month for the Woodcock Reading Mastery Tests. For the Key Math Diagnostic Arithmetic Tests there were 34 percent of the boys and 37 percent of the girls, respectively, who did not achieve the 0.1 grade pain per month.

The data for the Woodcock Reading Mastery Tests and the Key Math Diagnostic Arithmetic Tests were recorded in grade

equivalents. The pretest to posttest grade equivalent gains were averaged for the boys and girls for each test. On the Woodcock Reading the average gain for the boys was 1.1 grades and for the girls it was 1.1 grades. The gains were also converted to gains per month. Thus the average gain per month was 0.20 grades for boys and 0.25 for girls on the Woodcock Reading Mastery Tests.

On the Key Math the average gain was 1.4 grades for boys and 1.2 grades gain for girls. The average gain per month was 0.26 for boys and 0.22 for girls.

The statistical significance of the pretest to posttest gain for each test was evaluated using the correlated t-test. The gains for each test were statistically significant ($p = 0.5$) for both the boys and the girls.

Summary

The results of this study seem to indicate that:

1. Most of the students suffered from "behavior disorders" or "neuroses."

2. There is no significant correlation among the age at admission, I.Q. and length of hospitalization or between I.Q. and age at admission.

3. There is a significant negative correlation between years behind expected grade achievement and the pretest or posttest grade equivalent for Woodcock Reading and Key Math.

4. There was no significant correlation between severity of psychiatric diagnosis and grade equivalent gain per month for the Woodcock Reading and the Key Math.

5. There was a significant negative correlation between length of hospitalization and grade equivalent gain per month for the boys on both tests and for the girls on Woodcock Reading.

6. There was a statistically significant gain per month compared to the expected gain of a normal student.

7. There was a statistically significant gain between the pretest and posttest for the boys and the girls on the Woodcock Reading and the Key Math.

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Table 1

Correlation Coefficients for Woodcock Reading Mastery Tests

	Grade Equivalents: Years Behind Expected Grade Achievement	
Grade Equivalent	Male	Female
Pretest	-0.72	-0.59
Posttest	-0.49	-0.46

Table 2

Correlation Coefficients for Key Math

Diagnostic Arithmetic Tests

Grade Equivalent	Grade Equivalents Years Behind Expected Grade Level Male	Female
Pretest	-0.77	-0.80
Posttest	-0.75	-0.75

Table 3

Distribution of Students Behind Expected Grade Level for Woodcock Reading Mastery Tests and Key Math Diagnostic Arithmetic Tests

	Woodcock Reading		Key Math	
Grade Level	Male	Female	Male	Female
Pretest:				
Above	11	9	4	4
At	0	1	1	1
Below	26	24	34	33
Posttest:				
Above	11	12	7	7
At	1	2	1	0
Below	25	20	31	31

Table 4

Average Change in Grade Level between Expected Grade Achievement and Pretest or Posttest Grade Equivalent for the Woodcock Reading Mastery Test

	Male		Female	
Grade Level	Pretest	Posttest	Pretest	Posttest
Above	1.42	1.40	1.62	1.57
Below	2.60	1.80	1.97	1.54

Table 5

Average Change in Grade Level Between Expected Grade Level and Pretest or Posttest Grade Equivalent for the Key Math Diagnostic

	Male		Female	
Grade Level	Pretest	Posttest	Pretest	Posttest
Above	0.45	1.18	1.82	1.41
Below	2.89	2.33	3.15	2.56

Table 6

Rank Order of Psychiatric Diagnosis

Rank	Diagnosis
01	Transient Situational Disturbance
02	Special Symptoms
03	Behavior Disorders
04	Neuroses
05	Personality Disorders
06	Drug Dependence
07	Non-Psychotic Organic Brain Syndromes
08	Major Affective Disorders
09	Psychosis and Non-Psychotic Organic Brain Syndromes
10	Schizophrenia

Table 7

Total Gain in Grade Equivalent versus Severity of Psychiatric Diagnosis for Woodcock Reading Mastery Test for Total Sample

Grade Equivalent	Severity of Psychiatric Diagnosis							
	01	02	03	04	05	08	10	Total
Negative gain	0	0	0	1	1	0	0	2
No gain	0	0	2	9	1	0	1	13
Positive gain:								
0.1 - 0.5	1	1	5	6	0	1	1	15
0.6 - 1.0	0	1	3	3	1	0	2	10
1.1 - 1.5	1	0	4	4	0	0	1	10
1.6 - 2.0	0	0	4	3	3	0	0	10
2.1 - 2.5	0	0	6	0	0	1	2	9
2.6 - 3.0	0	0	3	2	0	0	0	5
3.1 - 3.5	0	0	1	0	0	0	0	1
3.6 - 4.0	1	0	0	1	0	0	0	2
Total	3	2	28	29	6	2	7	77

Table 8

Total Gain in Grade Equivalent versus Severity of Psychiatric Diagnosis for Key Math Diagnostic Arithmetic Test for Total Sample

Grade Equivalent	Severity of Psychiatric Diagnosis							
	01	02	03	04	05	08	10	Total
Negative gain	0	0	0	2	0	0	1	3
No gain	0	1	3	6	1	0	0	11
Postive gain:								
0.1 - 0.5	0	1	5	2	2	0	3	13
0.6 - 1.0	0	0	6	1	1	1	0	9
1.1 - 1.5	0	0	4	6	1	0	1	12
1.6 - 2.0	1	0	2	2	1	0	0	6
2.1 - 2.5	0	0	5	5	0	1	1	12
2.6 - 3.0	0	0	0	2	0	0	1	3
3.1 - 3.5	2	0	2	2	0	0	0	6
3.6 - 4.0	0	0	1	0	0	0	0	1
4.1 - 4.5	0	0	0	1	0	0	0	1
Total	3	2	28	29	6	2	7	77

Table 9

Pearson Product Moment Correlation Coefficients Between Length of Hospitalization and Grade Equivalent Gain Per Month By Sex

Type Tests	Male	Female	Combined
Woodcock Reading	-0.39	-0.38	-0.40
Key Math	-0.46	-.07	-0.25